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CENTRAL INTELLIGENCE AGENCY

## INFORMATION REPORT

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1. Results of the tests, which were made as a matter of company interest, were as follows:

## a. Hardness and Density

Two hard metal tips of Russian manufacture were submitted for examination. The tips were marked 0W0207 and 0N0709, the hardness and densities being as follows:

	ØW0207	ØN0709	
Hardness	1413 V.P.N.1/	1505 V.P.N. <sup>1</sup> /	
Density	14.80 grms/cc.	11.21 grms/cc.	

1/V.P.N. stands for "Vickers Pyramidal Number." V.P.N. are used to designate hardness in the very high range. A V.P.N. of 1500 would be roughly equivalent to 1725 Brinell if it were practicable to measure hardness of this degree by the Brinell method. Actually Brinell hardness measurements above approximately 600 are not considered accurate.

#### b. Analysis

	ØW0207	ØN0709
Total carbon Free carbon Titanium	5.59% Trace	7.53% .008% 11.84%
Cobalt	0.12% 7.22%	11.84% 6.06%
Iron	1.14%	1.17%

Spectrographic analysis showed traces of other elements.

### c. Microstructure

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The sample \$\mathbb{m}\$0207 was fairly free from porosity, but the microstructure showed a generally coarse and very mixed grain-size. The most unusual feature, however, was that the coarsest grain-size occurred in small isolated regions.

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(1) The reason for this structural defect is not clear, 25X1A but it appears from the shape of the crystals of tungsten carbide within the coarse grained areas, that these grains existed substantially in the same form prior to sintering; their presence is not due to grain growth during sintering.

- (2) This effect probably could be obtained if crushed sintered carbide scrap was incorporated in the powder before sintering, as is the practice of one Austrian Company (Edelstahlwerke of Reutte). It would be difficult to crush sintered scrap to a fine grain-size, and would result in coarse areas, as is exhibited by this sample.
- (3) Considering the fairly high titanium carbide content of specimen ØN0709, the material is reasonably free from porosity.
- (4) The microstructure showed a very coarse grain-size and the amount of free tungsten carbide was very high; it would appear that the titanium carbide has been added as such without forming, as is more usual, a mixed crystal of the titanium and tungsten carbides. In consequence, the structure is far less homogeneous than would be found in good quality hard metal.

#### 2. Conclusions

- a. Both tips are of fair quality, and the carbon content in each closely approaches theoretical, but the hardness figures are rather lower than would be expected for such compositions; the densities are satisfactory.
- b. The presence of more than one per cent of iron, while not influencing the structure or hardware to a great extent, would tend to affect strength and the tips would probably be inclined to be rather brittle.
- c. On the average, the material is much coarser than WIMET (tradename for Edelstahlwerke products) and this would explain the low hardness figures; the compositive material would therefore be less wear-resistant than the corresponding WIMET grades.
- d. Both Soviet tips contain larger crystals of tungsten carbide than a similar American product, which contains small and completely homogeneous crystal structure.
  - (1) Large crystals tend to pick out in use, causing the tip to crater.
- e. The Soviet tips show greater porosity than similar American products.
  - (1) Excessive porosity with inferior crystal structure results in a tip with non-uniform hardness.

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